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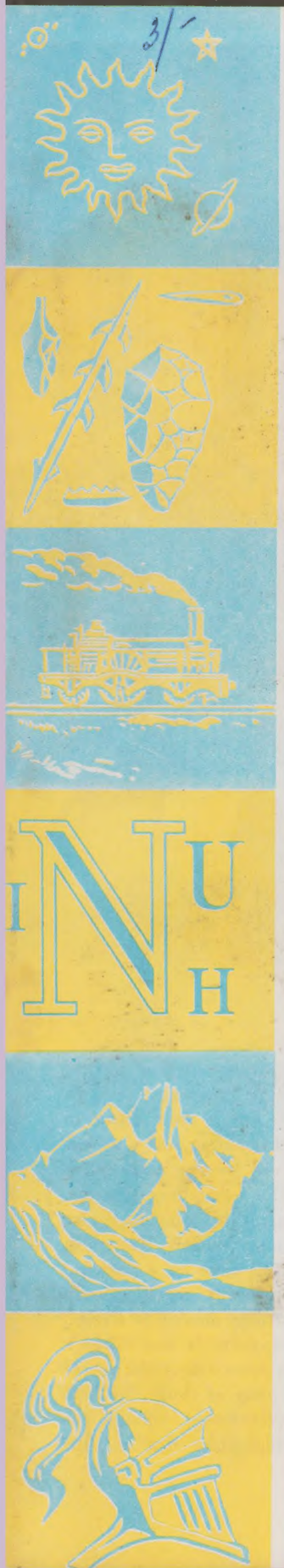

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Hitler salutes as the SS – his dreaded 'blackshirts' and personal bodyguard – march past

NAZISM

THE Nazi Party, or National Socialist German Workers' Party, sprang from the misery which followed Germany's defeat in the First World War. Political parties emerged in various parts of Germany, composed of people who were discontented with the regime which had brought Germany to defeat. One of these parties, founded in Munich in Bavaria, was the German Workers' Party. Adolf Hitler, a bitter, disillusioned ex-soldier, was its seventh member. His fervent energy, passion, and violent eloquence soon captured the leadership for him. Yet the party's growth was slow. In 1920 it had about 50 members. In that year it adopted its full name – the National Socialist German Workers' Party – and set out its programme in 25 points. It denounced the Treaty of Versailles and demanded a powerful, united Germany, with a strong army and extended frontiers. It also demanded 'living space' for the German people (which meant expansion in the east into Russian territory) and an unrelenting campaign of persecution against the Communists and the Jews. The Nazis put forward the doctrine of racial supremacy – that the Aryan, or Nordic, race was superior to all others.

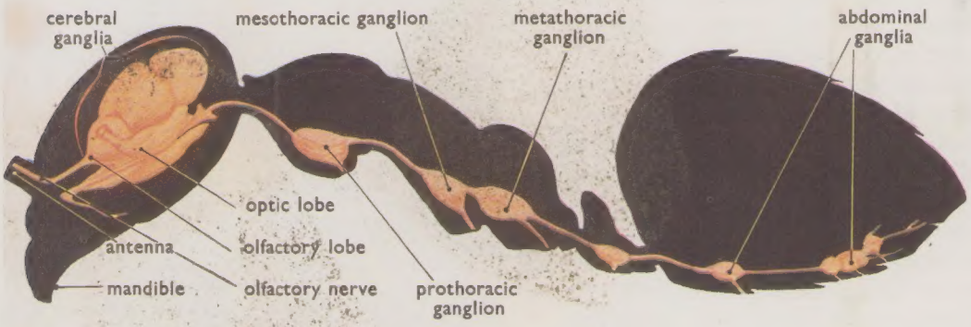
The Nazis advocated violence and soon organised a private army of 'brownshirts'. In 1922 their army numbered 800. In 1923 Hitler decided the time had come for a *coup d'état* to take over the government of Bavaria. This *putsch* was a miserable failure. The Nazi Party was dissolved by the authorities, and Hitler himself was imprisoned in the Landsberg fortress. It was in prison that he dictated *Mein Kampf* (his autobiography and political creed) to a fellow prisoner, Rudolf Hess. On his release Hitler refounded his party – this time on a national basis. He found in Josef Goebbels a brilliant organiser and propagandist, and the seat of Nazi operations moved to Berlin. As yet, however, the Nazis had little support. It was Hitler's demonic energy that kept his party going in years when most people regarded the Nazis as little more than a gang of thugs. In 1928 Nazis sat in the German Parliament (*Reichstag*), though the number of their supporters was then negligible. But in 1929

Previous page: Adolf Hitler, the German dictator who led the Nazi Party to triumph over most of Europe.

ANTS

ANTS are certainly the most 'intelligent' of all insects, and they even have some capacity for learning. They live in large communities, something like human towns or cities, and for this reason are known as *social*. All species of ants live in this way, and so do some kinds of wasps and bees, although there are many species of these which live normal, solitary lives. The only other social insects are termites or white ants, which are not related to ants at all: termites form the insect Order Isoptera, while ants, bees, and wasps are all included in the Order Hymenoptera.

We described an ants' nest on pages 1879–1881; here we give an account of how the different kinds of ants live.



The central nervous system of the ant

An important characteristic

The general anatomical features of the ant are typical of insects (see page 1006). It has, however, an unusually highly developed nervous system, with the cerebral ganglia of the head forming a definite brain. This feature enables ants to behave in a complicated and apparently intelligent way.

Three ants meet and investigate each other

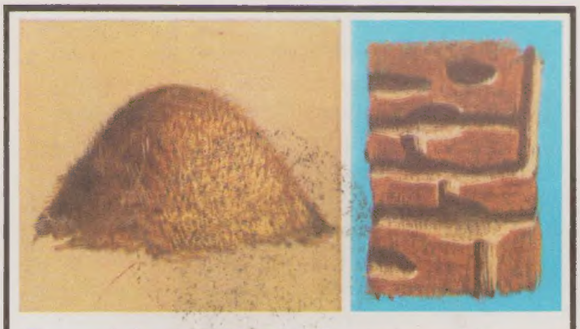
Senses

By far the most important sense-organs of ants are their feelers or antennae, which are combined organs of touch and smell. Whenever they meet, ants touch and investigate each other with their antennae. Some ants are blind, but those with eyes have a well-developed sense of sight and can distinguish colours. Not much is known about their hearing, but they can detect vibrations.

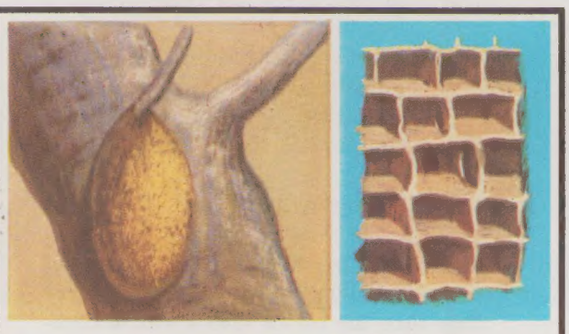
Many kinds of nests

On pages 1879–1881 we described the nest of one species of ant, the wood ant (*Formica rufa*). This consists of an underground portion covered over by a mound of dry vegetable fragments; both parts are traversed by numerous galleries and chambers in which the ants live. The yellow hill ant (*Acanthomyops flavus*) makes a mound of earth; this is the species responsible for the ant-hills thrown up in fields. Many species of ants make nests under stones or logs, or simply underground, with some of the galleries opening to the surface.

There are also ants which make their nests in trees. Some of these burrow into the wood, and the carpenter ants (*Camponotus*) of America do a great deal of damage, both to trees and to structural timber. Other species make nests of a paper-like substance, just as wasps do. These are called carton nests and consist of wood, chewed and moistened with saliva to form a pulp, which dries and hardens when used as building material. Most of the carton builders are tropical, and their nests vary in size from a few inches to the 6-foot-long carton of *Crematogaster schencki* of Madagascar.



The mound of earth overlying an underground nest; right: part of interior showing galleries and chambers



A carton nest made of wood pulp moistened with saliva; right: some of the compartments inside the nest

Carpenter ants, which make nests by burrowing in wood; right: burrows seen in section

Every ant has its own job

As we have seen (page 1879), the ants in a single nest are not all of one kind, although they belong to the same species. The 'queens' are simply fertile females who do nothing but lay eggs; the workers collect food, look after the young, and do all the other 'chores' about the nest; and the soldiers are concerned with its defence. Both the workers and the soldiers are sterile females. Male ants are born from time to time, but their only part is in the swarm, also described on page 1879.

When we survey the hundreds of different kinds of ants that are known, we often find the workers of various species doing highly specialised jobs, associated with the way of life of their particular species. Many of these activities can be paralleled in human society: there are ants which practise agriculture, growing crops or keeping 'cattle'; ants which store food; ants which wage war, and even make slaves of other ant species to do their work for them. Some of these are described and illustrated on this and the next page.

Harvester ants ①. These ants, found mostly in subtropical regions, collect grains of wheat, millet, and other cereals and store them underground.

If the grains get wet in times of flood, the ants bring them out to dry them on the surface of the ground. Sometimes seeds exposed in this way will sprout and grow, and this has led to the belief that the ants deliberately sow their own crops; of course there is no truth in this belief.

These nests are common in the Near East, and an ancient Jewish law, said to date back to Solomon, states that the seeds found in them must be given to the poor.

Leaf-cutting ants ②, ③, ⑤. These tropical American ants (Subfamily Attini) cut pieces of leaves from trees and take them into their nests, where they turn the leaves into a sort of compost. On this they grow a special kind of fungus on which they feed – this is the only food they ever take. When a queen flies off to found a new nest she always takes a little of the fungus with her to start a 'garden' for the new colony.

Engineer ants ④. Ants of the genus *Anomma*, living in Africa, have been seen to cross small streams by the method shown in the picture: a number of them form a living chain, holding on to each other with legs and mandibles; when this spans the water the other workers walk across it. Most ants can withstand long immersion in water without drowning.

Baker ants ⑥. Some of the ants which collect grain grind it up in their mandibles, moistening the 'flour' so formed with saliva, and then knead the 'dough' into little loaves.

Pastoral ants ⑦. A very common practice among ants is the keeping of aphids or greenfly, just as we keep cattle. The reason, too, is the same, for the ants 'milk' their aphids just as we do our cows. The fact is that aphids live on the sap of plants, which is mainly sugar and water, and there is always an excess of sugar in their excretions. When an ant wishes to milk one of its cattle it strokes it with its antennae; the aphid responds by producing a drop of sweet liquid, which the ant immediately licks up. Some ants tend and protect the aphids on the leaves and twigs of trees, while others take them into their nests and 'pasture' them on the roots of plants underground.

Honey-pot ants ⑧. Some of the workers of certain species of ants never go out looking for food, but stay at home, clinging to the roof of one of the chambers. The others go out and collect nectar from flowers, and feed the 'stay-at-home' ants until their abdomens become enormously swollen. In dry weather, when food outside the nest is scarce, these distended workers supply food, mouth to mouth, to other ants in the nest; they are, in fact, just living receptacles for storing food.

Ants at war

Ants are constantly at war, both with other nests or colonies of their own species, and with other species. The ants of a particular colony can all recognise each other by a distinctive 'nest-smell'. Any individual who has not this smell is known to belong to another nest and is treated as an enemy. Wood ants will often raid the nests of other species, killing the workers and soldiers and carrying off and eating the larvae and pupae.

Did you know?

1. There are about 8,000 different kinds of ants.
2. An ant grows only while it is a grub.
3. A queen mates only once.
4. A queen has been known to live 15 years.
5. The nest of the leaf-cutting ants may be 20 or 30 feet across and several feet high, and extend over 10 feet deep in the earth.

SLAVERY

Some kinds of ants have the extraordinary habit of making the workers of other species work as slaves in their nests. The blood-red ant (*Formica sanguinea*) is one of these. These ants raid the nests of the black ant (*Formica fusca*), bringing the larvae and pupae back to their nests. Instead of eating them, they treat them as if they were their own young and feed and rear them. The adult black ants acquire the 'nest-smell' of the blood-red ants' nest

Several different kinds of ants are shown here in and around the same nest. Of course they do not really live like this – in fact they inhabit different countries. We have done this to make a better picture

and work in it as if it were their own home. When blood-red ants raid some other species (not the black ant) they eat the larvae and pupae.

ENEMIES OF ANTS

Not many animals will attack ants in their nests, but the pangolins of Africa and Asia and the South American ant-eaters live entirely on ants and termites. In Britain the green woodpecker attacks ants' nests, extracting the insects with its long, sticky tongue.

Pangolin

Both these animals feed on termites or 'white ants' as well as on true ants

Anteater

The new method of choosing an emperor. The old emperor has died, and the legionaries in a frontier camp acclaim their own general (standing

FROM MARCUS AURELIUS TO CONSTANTINE

MARCUS AURELIUS, Emperor of Rome between A D 161 and 180, succeeded to an Empire that had enjoyed almost a century of good government and prosperity. But during his reign frontier wars threatened the Empire, and it was ravaged by a great plague. His son, Commodus, who succeeded him, proved another Nero (see page 1076). He was corrupted by power and evil advisers, and became increasingly mad; in 192 he was murdered.

From that year on, the power of the Roman Empire was openly in the hands of the soldiers. Commodus's successor, Pertinax, who tried to restore the authority of the senate and the discipline of the troops, was soon murdered by the Praetorian Guard. The Guard then put the title of emperor up for auction, and sold it to the highest bidder – Didius Julianus, a senator whose only qualification for ruling was his money. Meanwhile on the frontiers the Roman legions acclaimed three other emperors; and out of the struggle which followed, Septimius Severus (193–211) emerged as emperor. But the armies now knew that they could act as kingmakers, and successive emperors were forced to curry favour with them.

Severus's son and successor, Caracalla, was overthrown in 217, and there followed 12 emperors over the next 36 years, not one of whom died a natural death. And in the anarchy of the mid-3rd century it is almost impossible to keep track of the emperors, so many were acclaimed locally in the frontier provinces. With the accession of Claudius Gothicus in 268 some stability returned, but it was not until the drastic reforms of Diocletian that the Empire recovered from the damage of the 3rd century.

The Roman Empire in the time of Diocletian (3rd century A D)

Barbarian invasions; financial difficulties

The damage to the Empire was done from outside and from within. Externally, the Empire was troubled more and more by barbarian invasions, which were the major cause of its eventual fall (see page 72). The Goths invaded the Balkan peninsula and Asia Minor from their base on the lower Danube, and the Franks, Alemanni, and other Germanic tribes, pushed out of their lands in northern Europe by other migrating tribes, moved southwards in search of new homes. Plundering and burning, they swept through the frontier provinces. Meanwhile, the Empire was under attack in the east from the Persians.

The Roman Empire was also being undermined from within by the creeping disease of 'inflation', and the 3rd century was a time of economic chaos. There were many reasons why it was difficult for emperors to raise enough money. The wars against the invading tribes were expensive, and the army had to be enlarged to meet its increasing commitments. Septimius Severus, realising how important the army was – not only because it protected the frontiers but because it could create a new emperor if dissatisfied – increased the soldiers' pay, and Caracalla did the same. All this strained the Empire's resources. Yet there was only one big increase in taxation in all this time, and the complicated and wasteful methods of assessing taxes were not altered until Diocletian's reign.

Instead of reforming the tax system and raising new taxes, the emperors simply devalued the currency, by making more money. Septimius Severus, for instance, reduced the amount of silver in the *denarius* (the standard silver coin) to 60 per cent,

on the rostrum)

and other emperors followed suit. In about 200 the denarius was almost pure silver; by 300 it was made of bronze with just a thin silver plating. But the emperors could not create more goods for the money to buy. The result of this was that prices rose and the same amount of money bought less and less. The soldiers were encouraged to supplement their pay by looting, and the civil servants by accepting bribes. So chaotic were the Empire's finances that soldiers and civil servants later began to be paid in kind, with wages of corn instead of money. Again, it was left to Diocletian to straighten out the economic muddle.

The one big increase in tax came when Caracalla granted the coveted Roman citizenship to all free men in the Empire in 212. This sounds like an enlightened measure, spreading the privileges of citizenship to loyal subjects, and making Rome 'the common fatherland'. But in fact, by now, many of the privileges of citizenship had disappeared; and since all citizens were liable to tax, it was a convenient way of raising money. In place of the old distinction between citizens and non-citizens there arose a new distinction between two classes of citizens: the *honestiores* (nobles) and the *humiliores* (lower class).

Bust of Septimius Severus (AD 193–211)

Septimius Severus was the first emperor to realise how the Empire had changed, and to cater for these changes. He had no time for the senate, which former emperors had at least pretended was the 'partner' of the imperial power. Instead, Septimius appointed soldiers to many of the most important jobs in the Empire. He was the soldiers' emperor; he created new legions, as well as increasing the army's pay and privileges. Septimius died at York after 3 years' campaigning in England and Scotland. With his last breath, it is said, he advised his sons to co-operate with each other and to pay the army well.

Bust of Caracalla (211–217)

Caracalla, the elder son, followed the second piece of advice, but not the first; he soon murdered his brother Geta and became sole emperor.

But his reign lasted only six years and, as we have seen, was followed by a period of confusion.

A strong emperor was found again in 268 – **Claudius,** called 'Gothicus' because of his great victories over the Goths, who were plundering the Balkans. Claudius, however, soon died. His successor, **Aurelian,**

Gold piece showing Aurelian (270–275)

continued with the conquest of the invading tribes, and crushed the rebel kingdom of Palmyra in the east, where a woman, Zenobia, held Egypt and Asia Minor in defiance of Rome. Aurelian even tried economic reforms. But the fact that he had to build a wall round the city of Rome is a

Bust of Diocletian (284–305)

sad comment on the strength of the Empire in this century of barbarian invasions. After Aurelian's assassination in 275 the pressure of these tribes did not slacken; **Probus** campaigned against them on the northern frontiers.

Two years after the army killed Probus, **Diocletian** became emperor. He was the son of a freedman who had risen through the ranks of the army until he became commander of the bodyguard of the Emperor Numerian. When, on 17th September 284, Numerian was found dead in mysterious circumstances, the young Diocletian was acclaimed in his place. Many emperors had started the same way and had not lasted long. Diocletian was different. He reigned for 20 years, and at the end of that time he laid down the imperial power of his own free will. As a planner and reconstructor he was second only to Augustus (see page 1904), and his reforms shaped the character of the Empire for the next 300 years. Diocletian paved the way for his great successor, the Emperor Constantine (see page 672) who founded Constantinople and established Christianity as the official religion of the Roman Empire.

Statue of Constantine (306–337)

Part of the great walls which Aurelian built around Rome

THE MOST IMPORTANT 3RD-CENTURY EMPERORS

Septimius Severus	193–211
Caracalla	211–217
Claudius Gothicus	268–270
Aurelian	270–275
Probus	275–282
Diocletian	284–305

CITIES OF EGYPT

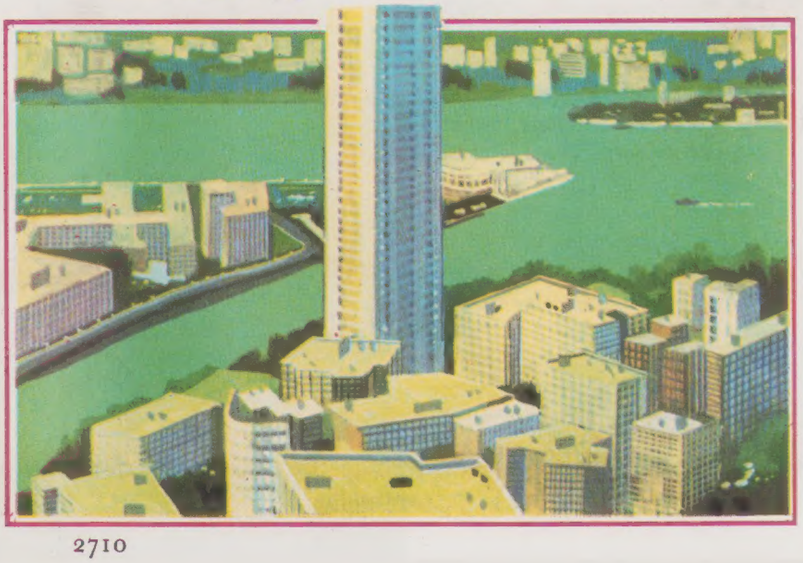
SINCE the days of the Pharaohs the Egyptians have been an agricultural people, living sandwiched between great deserts in the valley of the Nile and its delta. Indeed, the Nile ought to be described as Egypt's 'life-flood'. Today most of Egypt's 26 million people still live in villages. There are only two cities with more than a million people, and 13 with more than 100,000, but President Nasser's ambitious plans to make Egypt more industrial and self-sufficient may gradually change this and bring more people to the towns.

Cairo

Cairo, Egypt's capital, is the largest city in Africa and the centre of the Arab world, although its development as a great city is only fairly recent. It lies in a dominant geographical position on the long, snaky, cultivated strip of the Nile valley, just before the Nile starts to divide and subdivide into the wide, fertile triangle of its delta. Cairo began as a series of small military settlements. The first town was built in AD 641 by 'Amr, a general in the army of the Caliph of Baghdad; it got its name when Gawhar, a Tunisian general, built a new city, El Quahira, in 969. (Cairo is the Italian form of this name which means in Arabic 'the victorious'.) Saladin, the Crusaders' great opponent, extended the city to include the mound of the Citadel, which is still a military fort, and dominates the city to the east. Before its decline in the 16th century Cairo was the great centre of Muslim art and learning; the foundations of several of the city's 400 mosques were laid then, and students still come from all over the Muslim world to the university of Al Azhar, founded in AD 970.

Cairo first gained political importance in the 19th century. It was revived from a long decline by the Pasha Mehemet Ali, founder of modern Egypt, and was made capital of Egypt in 1866. Since then the city has grown rapidly, encroaching on the desert around it and taking in a wide strip of the western bank of the Nile. Europeans, especially English and French, have flocked in, their buildings and style influencing Egyptian taste and turning Cairo into the great city it is today, with about 3,346,000 inhabitants, three universities, and a world-famous museum of Ancient Egyptian art.

In Cairo, Arab influences mix quite easily with newer European ones. Bands of teenagers go arm in arm, half of them dressed in jeans and T-shirts, half in Arab *djelabiehs*. And next to a modern airline office there is likely to be an untidy little shop, its owner sitting cross-legged among his wares, smoking a hubble-bubble pipe.



Skyscrapers and wide thoroughfares proclaim the strong western influence on Cairo, Egypt's modern capital

Standing on the Citadel hill you see most of the city, spiky with minarets and a new radio tower. Below lies the old Arab town with its narrow streets, bazaars, and donkey-carts; its sounds and smells rise towards you. Further west are the offices and blocks of flats of modern Cairo, and the garden city along the Nile's east bank where most of the embassies and smart hotels are. North-east, towards the new airport, is the spacious suburb of Heliopolis, full of large detached houses. In one of these lives President Nasser. To the south-west you catch a glimpse of Nasser's new Egypt, in the heavy industries such as steel, coal, and cement which he has promoted at Helwan. And the whole beautiful, muddled complex of the city is dominated by the distant Giza pyramids, built 5,000 years ago.

Alexandria

Alexandria (population 1½ million), known as Egypt's 'second capital', was the real capital for more than 1,000 years. Alexandria's roots are European and Christian, unlike Cairo's, which are Arab and Muslim. In 331 BC Alexander the Great marched into Egypt, took over an old city of the Pharaohs, and renamed it Alexandria. Alexander's city rapidly became one of the most important ports in the Mediterranean, crowded with Jewish and Greek merchants trading with Arabia and the East. Its lighthouse on Pharos Island (now silted up and part of the city) was one of the Seven Wonders of the Ancient World. Under the Roman Empire it was second only to Rome in importance, and became the centre of Jewish learning and Christianity – there is a legend that the Alexandrians were converted by St Mark.

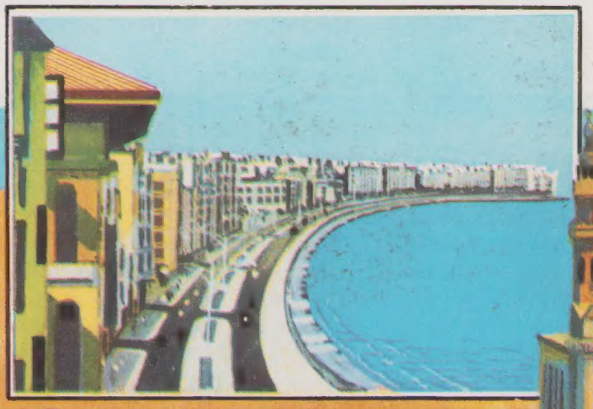
The elegant minaret on one of Alexandria's finest mosques

In the Middle Ages Alexandria's importance as a port gradually dwindled, and the discovery of the Cape route to India in 1498 was almost a death blow. But it came back into European politics when Napoleon conquered it in 1798.

Like Cairo, Alexandria owes its revival to Mehemet Ali, who began rebuilding the city along its modern, very European lines, and created its deep port. Today hardly a trace of the ancient city remains.

For almost a century after 1866, when Cairo became the official capital, Alexandria stayed the gayest, smartest, most cosmopolitan city in Egypt, especially in summer when the government moved there to escape Cairo's burning desert heat and to enjoy Alexandria's milder Mediterranean climate and fresh breezes.

Today Alexandria is still a delightful city and summer resort, with its famous long sea-front and pleasant boulevards. Its



The magnificent, modern sea-front at Alexandria

OTHER CITIES

Three of Egypt's biggest towns owe their existence to the Suez Canal. Port Said at the north end of the canal, which has about 244,000 inhabitants, was founded in 1859. Halfway down is Ismailia, which is smaller but more attractive; its wide boulevards, squares, and trees give it the air of a French town. It is pleasantly situated on the shore of Lake Timsah. Suez, with 203,000 people, lies at the canal's southern end.

Egypt has other large towns, like Tanta (population 140,000) which is at the centre of a rich agricultural district in the delta, between Cairo and Alexandria. Two small towns are also worth mentioning. At Aswan, famous for granite quarries, dams, and winter tourists, Russian and Egyptian engineers are building the great high dam which will vastly increase Egypt's agricultural land and electric power, and turn the country 400 miles to the south into a huge lake. Farther north is Luxor, a growing tourist centre. It stands on the site of Thebes, capital of the Pharaohs of the New Kingdom (1575–1200 B C); there they built the great Karnak temple, and, with their wives and nobles, were buried in the rocky valleys across the Nile.

Cairo: the Sultan Hassan mosque

Port Said: statue of De Lesseps, builder of the Suez Canal

The three pyramids built at Giza for Pharaohs of the 4th Dynasty

The monastery of St Catherine at Sinai; her body is said to have been miraculously transported there

Antinoöpolis: the Emperor Hadrian's memorial to his favourite, Antinous

Two statues of Amenhotep IV, known as the Colossi of Memnon

The gateway of the Great Temple at Karnak, built in the 3rd century B C

The old dam at Aswan

The temple of Isis at Philae, submerged for much of the year by the waters of the Nile

The 65-foot-high Colossi at Abu Simbel

A typical street in the old part of Cairo

'Pompey's Pillar', towering above Alexandria. (In fact it was erected in memory of Diocletian.)

port handles over 80 per cent of Egypt's trade, including its important cotton exports. It also has many industries, notably cotton spinning and weaving, oil pressing, rice milling, brewing, and the making of paper, soap, and bricks. But since 1952, when King Farouk was deposed, it stopped being used as a summer capital. 'Alex' has become more provincial; the real centre of gravity has finally shifted to Cairo.

BUILDING STONES

This modern building depends on the stone and stone products listed on the left

ABOUT 5,000 years ago a king instructed his architect to build a tomb. In size and in splendour this tomb was to surpass every building in the world, and, even more important, it was to endure for ever. In consequence there stands at Sakkara in Egypt, virtually intact to this day, the great Step Pyramid. It is the tomb which Imhotep the architect built for Zoser the king. It is also the ultimate proof of the strength and durability of stone as a building material.

Since the time of Imhotep architects the world over have used stone in their buildings. The Greeks used it for their temples, the Romans employed it in their amphitheatres, and the great religions of the world have built their cathedrals, churches, mosques, and temples with it. To each building, stone has imparted its strength and durability, and, what is more, its beauty. Though there are now many new materials with which architects may add strength and durability to their works, the ability of stone to beautify remains unsurpassed.

DIFFERENT KINDS OF STONE

Geologists recognise three great groups of rocks, and in each of these groups there are stones suitable for building.

Igneous rocks are very old. They were at one time molten, but have solidified as the earth has cooled. Granites are rocks of this type.

Sedimentary rocks consist of particles which have been deposited in layers by rivers or seas. Sandstone and limestone are examples.

Metamorphic rocks are sedimentary rocks which have been altered by heat and pressure. Slate and marble are important varieties.

Although large stones, either rough or shaped, are the most obvious feature of masonry, it must not be forgotten that much smaller stones have an important part to play in building. Small stones, either from the sea shore or from river beds, are used in concrete, and gravel from gravel pits is used for paths and roads. Sand, which is merely small grains of sandstone, is used in the preparation of mortar, cement, and concrete.

Gravel banks at the side of a river

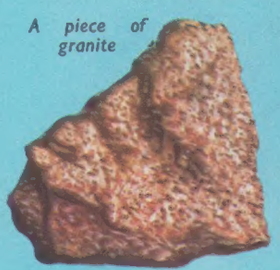
A section of railway track in which the wooden sleepers are laid on small pieces of stone

Small pieces of stone are often used in situations where it is necessary for rainwater to drain away rapidly. Railway tracks provide an obvious illustration, and it is usual for the sleepers to be laid on a bed of stone fragments known as *ballast*.

Marble – This metamorphic rock arises from limestone beds which have been subjected to great heat and pressure. The stone is usually white with coloured veins, though brown, green, and even black marbles are known.

Marble can take a glass-like polish, and because of this it is often used decoratively rather than structurally. It is fixed in thin slabs to walls and floors which are constructed of less exotic materials.

Marble and one of its uses



A piece of granite

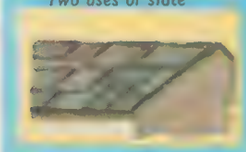
Granite – This igneous stone is one of the hardest and so is used extensively for kerbstones and other structures exposed to very hard wear. Though its hardness makes granite difficult to work, it is sometimes polished to decorate imposing structures.

A granite fireplace

A piece of sandstone

Sandstone – This sedimentary rock consists of grains of sand held together by a cementing substance, or *matrix*, which may be silica, calcium or magnesium carbonate, oxides of lime, or clay, depending on the quarry from which the stone is obtained. This determines both the appearance and the usefulness of the stone. Sandstone with a clay matrix is soft and of little use in building; that with a silica matrix is one of the best and most popular of all building stones. The colour of sandstone is due to the presence of salts, usually of iron.

Two uses of slate



A piece of slate

A slate roof

Slate – This metamorphic rock is formed from clay which has been compressed at very high temperatures. As a consequence of this compression the clay hardens and develops marked lines of cleavage. It is these planes of cleavage which make it possible for a skilled slate-worker to split a block of slate into a large number of thin sheets. Slate is quarried in the Isle of Man, in North Wales, in the Lake District, and in Devon and Cornwall. Most of the stone is a dark-blue colour, but that obtained from deposits in the Lake District has often a delightful green tinge.

Because it is possible to work slate into thin sheets, or *slates*, the stone is an ideal covering for roofs. It is in this form that slate is most familiar. In regions close to slate quarries, however, thicker pieces of slate are often used for building the walls of houses. Slate is sometimes used for blackboards, the tops of laboratory benches, and for the beds of billiard tables.

A piece of limestone

Limestone – Though all limestone consists of the salt calcium carbonate, not all deposits were formed in the same way. Some consist of the shells of countless numbers of small molluscs while others are the result of chemical precipitation in large volumes of water. Limestone varies in character from stone of considerable hardness to soft crumbly chalk. It is usually white. The best-known limestone in Britain is undoubtedly the Portland stone of Dorset. Christopher Wren used it for St Paul's, and since then it has been employed for thousands of buildings to which architects have wished to give an air of reassuring solidity. Limestone is attacked seriously by polluted atmospheres.

Flint – This rock is found chiefly in the eastern and southern parts of Britain. The stones vary in colour from white, through grey and yellow-brown, to black. They are very hard but rather brittle. Most flints are quite small, and the stones obtained from quarries are very rough and irregular in shape. Flints from stony beaches have usually been washed smooth by the action of the waves. These features make flint a particularly difficult stone with which to build, not least because the amount of mortar needed to fill the spaces between the stones is very large.

Some of the finest examples of building in flint are the stone churches of Norfolk and Suffolk. Houses built in flint are to be found in the counties of Kent, Sussex, Hampshire, and Wiltshire.

SOME EXAMPLES OF THE WAYS IN WHICH STONE IS USED IN BUILDING

The simplest way of building a stone wall is to use unshaped stones arranged at random. However, much mortar is required for this kind of work.

In this wall, roughly-shaped stones are arranged in *courses*. The slab of stone on the top protects the wall and gives to the whole a finished look.

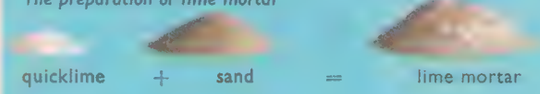
Hardwearing granite is an excellent stone for outdoor steps in public places. Indoors, marble steps are sometimes used to lend an air of grandeur.

Stone like marble and Portland stone, which can be split or cut into thin sheets, is often used to cover inexpensive brickwork or concrete.

LIME MORTAR, CEMENT MORTAR, PLASTER

In some methods of building with stone the stones are arranged together without any bonding material. The *dry stone walls* of Derbyshire and of the Lake District are wonderful examples of this particular skill. More usually, however, stones are held with mortar or cement.

The preparation of lime mortar



A piece of cement after it has set

Lime mortar – When limestone is heated it decomposes to form a powder, *quicklime*. This powder is mixed with water to form a paste called *lime* which is then mixed with about three times as much sand to form lime mortar.

Lime mortar was once used for almost all stonework. It has now, however, been largely superseded by cement mortar.

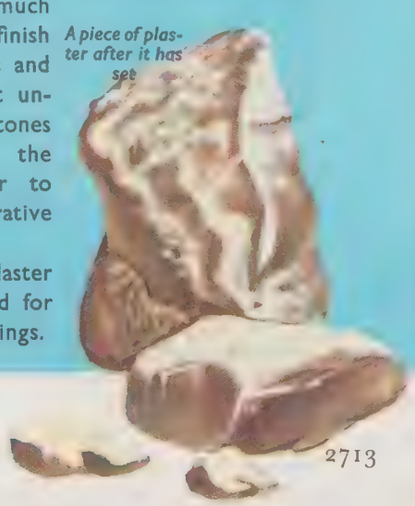
Cement mortar – Cement is made by roasting a mixture of chalk and clay in a long rotary kiln. The product is a grey powder, which, when it is mixed with water, sets into a hard mass. To make cement mortar the cement is first mixed with three or four times its own weight of dry sand. Water is then added to the mixture, until a mass

The preparation of cement mortar

of the desired consistency is obtained. Various materials such as dyestuffs and powdered stone are sometimes added to cement mortar so that its colour will match that of the stonework in which it is being used.

Plaster – Plaster is made by heating lumps of gypsum (calcium sulphate) in a kiln. The powder so formed sets rapidly when mixed with water, and is therefore much in demand as a finish for interior walls and ceilings. It is not unusual for small stones to be added to the plaster in order to provide a decorative effect.

In addition, plaster is also often used for decorative mouldings.



A piece of plaster after it has set

R E L A T I V I T Y

IMAGINE that you are alone, out in space, far away from any stars and galaxies, with nothing at all in sight to use to measure your speed. You cannot possibly discover whether you are moving or not. Suppose that suddenly you discover a very faint star and find that you are getting closer to that star at a rate of 10,000 miles a second. Are you moving towards the star or is it moving towards you? There is no way of telling. Your information only tells you your motion *relative* to the star. It is, in fact, meaningless to ask which is moving. There is no way of finding your true motion in space or here on earth, because nothing in our Universe is at rest – *everything* is moving around with its own velocity relative to everything else.

This very moment you are hurtling through space at 500,000 miles an hour. 'Ridiculous,' you may say, 'I'm sitting quite still in my chair reading *Knowledge*.' We are both right in a way, for, remember, all motion is relative. You may be sitting still relative to the earth, but the earth is turning you about its own axis at about 670 miles an hour (if you are in London; it is much less nearer the poles). Moreover, the earth is speeding around the sun at 67,000 miles an hour, and the sun is rotating around the centre of the galaxy at 500,000 miles an hour. It is clear that the velocity of any object can only be measured relative to some other body (which in turn may be moving).

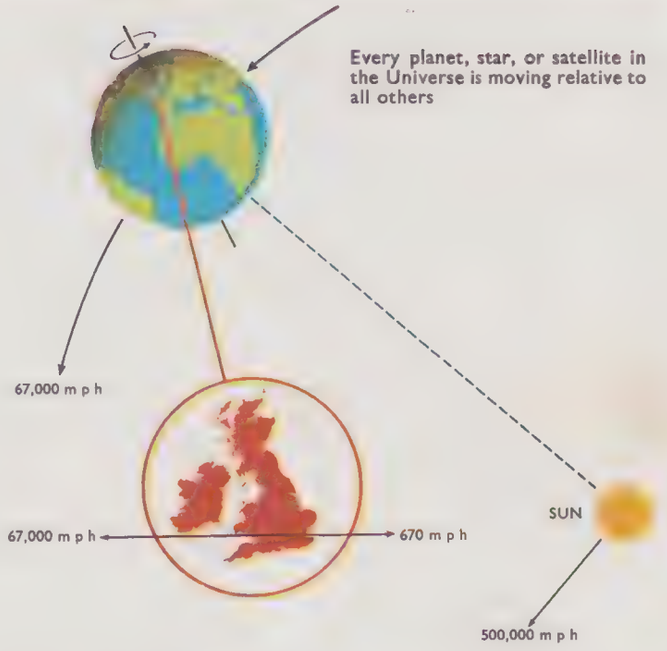
The velocities we have been dealing with so far are quite small when compared with that of light, which is about 186,000 miles a second. When we try to explain the more obvious motions of the earth, the planets, and the sun, we find that the laws of motion established by Newton in the 18th century give the correct solution to our problems. But, as soon as the relative velocity between two objects approaches that of light, some very curious things begin to happen which cannot be explained using our everyday ideas about motion.

The Special Theory of Relativity

These curious effects were first predicted by Einstein in 1905, in his Special Theory of Relativity. This theory was invented to explain some perplexing problems about the nature of light. The mathematical basis of this theory is too complicated to explain in such a short article. We will just see what Einstein's ideas and conclusions were. But you must realise that in dealing with this fantastically complex idea we will be going into a world in which ordinary human terms are quite meaningless; a world in which the physical laws are completely different to our own; a world in which the concepts of even time and space change and intermingle.

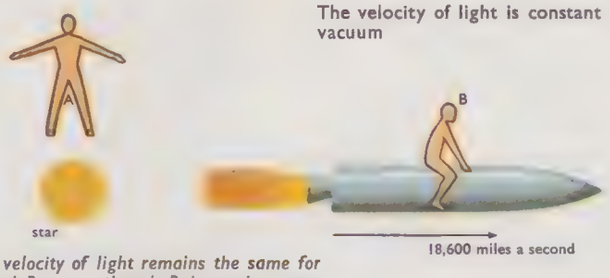
Einstein first assumed that all motion is relative, and that nothing is absolutely at rest. This means that two observers (an observer is anyone equipped with a means of measuring length and time), each of whom appears to the other to be moving at a constant speed in a straight line, cannot tell which of them is moving. The second assumption is that the velocity of light in a vacuum is the same for all observers who are moving with a constant speed in a straight line. It makes no difference what their speed is.

In diagram ① a spaceman (A), at rest in relation to a star, will find that the velocity of the light from the star is 186,000 miles a second. But a second spaceman in a rocket (B), which is moving at 18,600 miles a second away from the star, will also find that the velocity of the star's light is 186,000 miles a second, and not 167,400 miles a second as one might suppose.


Every planet, star, or satellite in the Universe is moving relative to all others
67,000 m p h
67,000 m p h
670 m p h
SUN
500,000 m p h

How can this be? There is only one way of explaining such facts, and that is that the clock on the spaceship, which was used in the measurements, was, in some way, affected by its motion. This does not mean that the clock had gone wrong – it means that time itself had slowed down.

Diagram ①



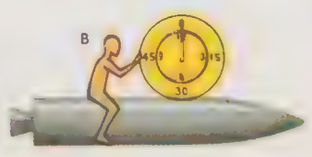
The velocity of light remains the same for A and B – even though B is moving away from the source of light

Slowing down of time

Again let us take our two spacemen. This time one (A) is seated on an asteroid and the other (B) on a rocket travelling past the asteroid at a steady velocity of 161,000 miles a second. Each spaceman is equipped with a clock, and just as they pass (see ②), they synchronise their clocks. A waits for 30 seconds on his clock, and then takes his telescope to look at

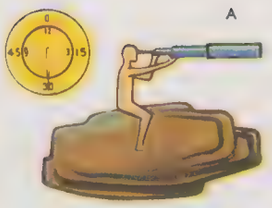
Diagram ②

This and diagram ③ show that near the speed of light time slows down



When A and B pass they synchronise their clocks

Diagram ③



Near the speed of light time slows down

When A looks forward at B's clock he sees it has only recorded 15 seconds, while his has recorded 30

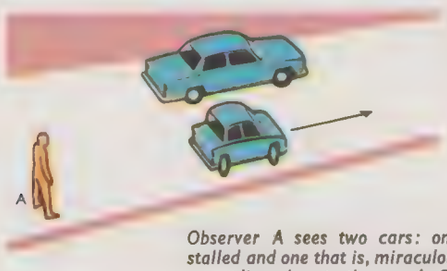
B's clock (see ③). After allowing for the time the light takes to reach A from B, A finds that B's clock is only going half as fast as his own. This is one of the seemingly mysterious aspects of relativity. The effect is the same whether B is approaching A or receding from A. If we now give B a telescope to look at A's clock, he will find that A's clock is only going half as fast as his. The change in B's time as seen by A is exactly the same as A's time as seen by B. This must be so because there is no way of saying whether A is moving or B is moving; everything is relative.

Contraction in length

The second important conclusion that comes from Einstein's theory is that if we have an object B moving relative to A, near the velocity of light, the length of B in the direction in which it is moving will appear to contract when viewed from A. To make this clear, let us imagine that one day, for some magical reason, the velocity of light were reduced to 60 m p h. In diagram ④ we have observer A watching two cars. One has stalled, the other is travelling at 52 m p h – very close to our 'reduced velocity of light'. This second car will appear to A to be squashed to half its length and its wheels will seem oval-shaped, but it will be the same width and height as the other. It has contracted due only to its velocity. Since these effects depend only on relative velocity, if the driver of the second car were to look out of his window he would see both the stalled car and our observer, both apparently squashed to half their normal lengths, but he would find nothing at all odd about his own car.

Of course, it is not possible at present to accelerate rockets (let alone cars) to velocities near to the real velocity of light. However, certain tiny nuclear particles can be accelerated to within one-tenth of a mile a second of the velocity of light, and it is these that are used to test the theories.

Diagram ④



Near the speed of light lengths become shorter

Observer A sees two cars: one that has stalled and one that is, miraculously, travelling close to the speed of light

Mass increases with velocity

But before we discuss the proofs there is one more prediction, made by Einstein, that must be looked into. He said that the mass of an object increases as its velocity increases. This is another odd effect. To make it clearer, let us imagine a body being twirled around on the end of a piece of string. Every time the body passes one point, it is given an identical push, or, more scientifically, it receives the same increase in energy. If we work out what increase in velocity the body should receive using the mathematics of Newton's day, we would find that the velocity does not in fact increase as much as it should. Energy cannot be lost. Some of the energy which we gave to the body must have become mass.

Even if we heat up a body we give it more energy, and its mass will imperceptibly increase. Although it is difficult to believe, energy and mass can be converted one into the other. When energy is given to a body, its mass increases; and when mass is destroyed, energy is released.

Proof of the Special Theory of Relativity

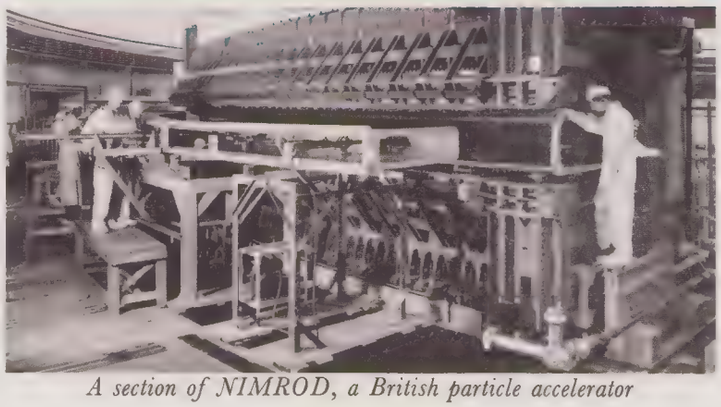
To show that these three curious phenomena really exist, we must go into the realms of nuclear physics. These, you will remember, were that: near the speed of light time intervals become longer; lengths shorter; and masses heavier. It happens that, as a result of the mathematics of Einstein's theory, if we can prove that lengths become shorter, it follows that times become longer, and *vice versa*. It is easier to prove the latter.

The evidence for the first two comes from observing *cosmic rays*, which are nuclear particles from outer space. These cosmic rays hit the top of our atmosphere at speeds approaching that of light, and emit small particles called *mesons*, which disintegrate a short time after they are formed. It is found that the faster the mesons are moving, the longer it takes them to disintegrate from the point of view of a scientist on the earth. The time interval between the birth and death of a meson has apparently grown longer.

The third prediction of Einstein, that mass increases with increasing velocity, was first seen to be true in early experiments with radioactivity. When measuring the mass of electrons emitted by a radioactive substance, it was found that the mass of the electron depended on its velocity just as Einstein foresaw. Today this increase must be taken into account when giant particle accelerating machines are built. The main purpose of these machines is to accelerate various nuclear particles to almost the speed of light. In some machines the mass of each particle may be increased up to 30 times its original value as a result of its high velocity.

NO VELOCITY GREATER THAN THAT OF LIGHT

If an object could move at the speed of light its length would appear to shrink to nothing (it would be invisible) and its density and mass would become infinite. This means that an infinite amount of energy would be needed to accelerate it. An infinite amount of energy means all the energy in the Universe many times over. So clearly nothing can travel at the velocity of light; this must be the maximum possible velocity that any object can possess.



A section of NIMROD, a British particle accelerator

CANE SUGAR

THROUGHOUT the early history of man the only substance known to have a strong sweet taste was honey. When Alexander the Great invaded western India in 325 B C his soldiers encountered a kind of 'honey not made by bees'; this was the first European contact with cane sugar.

Production of it spread westwards only very slowly, so that in mediaeval times, when the Crusaders were on campaign in eastern Europe, it was still scarce and precious. The Crusaders called all peoples who did not profess their religion 'pagans', and 'pagan honey' was the name which they gave to this mysterious and delicious sweet substance.

For a time after its introduction into the Mediterranean region sugar was controlled by the merchant houses of Venice, who shipped it to western and northern Europe at great profit. But as the Portuguese and Spanish colonisers pressed westwards across the Atlantic they took the plant with them, and in the 16th century the sugar industry of the New World came into being. Until the early 19th century all commercial production of sugar depended on the sugar cane.

AN HISTORICAL OUTLINE

Sugar cane probably originated in south-eastern Asia, and reached India and southern China not later than 500 B C. By A D 500 it was cultivated in Persia, and 100 years later in Egypt. When the Arabs advanced westwards along the Mediterranean they brought it with them, and it was growing in Spain in A D 755. Later it spread to Sicily and Cyprus. In the 15th century the Portuguese introduced the sugar-cane industry to Madeira and the Canaries, and in the 16th century they and the Spaniards took it to tropical America and the West Indies, where Brazil and Cuba became the largest producers. Important industries have now developed in Java, the Philippines, and Australia.

Cutting sugar cane; the canes must be cut close to the ground

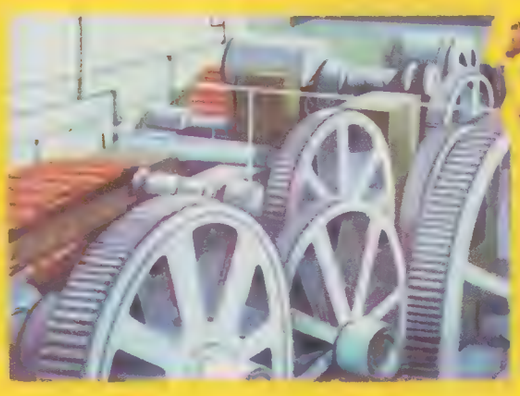
Loading sugar cane on a large plantation in South America

HARVESTING AND PROCESSING

When the crop matures tests are made of the sugar content, and the canes are cut when this is judged to have reached its highest point. This is usually a short time after flowering. The canes are so thick and tangled together that cutting them by machinery presents considerable difficulties, and most sugar cane is cut by hand, the cutters using a heavy cutlass or machete. After cutting, the leaves are stripped off the canes and used as cattle fodder or for fertiliser.

At the factory the canes are first crushed between rollers, which remove about two-thirds of the juice. The crushed cane is then sprayed with water, to dilute the remaining juice, and passed through rollers again. By this means nearly all the sugary sap is removed. The residue, which consists mainly of cellulose, is called *bagasse*, and has various uses.

The juice that is crushed from the cane is a greyish liquid full of impurities, most of which are removed by boiling the juice and adding lime; this causes them to sink to the bottom. Crystalline sugar is produced by the boiling and evaporation of the purified juice, and white or refined sugar is made by absorbing the brown colouring matter with bone charcoal.



Part of a modern sugar press

An old-fashioned sugar press in action

because the lowest part is the richest in sugar

The plant and its cultivation

Sugar cane (*Saccharum officinarum*) is a large, perennial grass which is not now known in the wild state. It grows to a height of 8 to 20 feet, and the stems or culms may be 2 inches in diameter. The formation of the stems, which consist of spaces or internodes separated by rings or nodes from which the leaves arise, is typical of the grass family (see page 2525). At each node there is also a bud and a number of whitish spots marking embryonic roots, and from these a new plant can grow. These buds frequently sprout while still attached to the parent plant, and one is shown growing from near the base of the cane in the illustration below. The stems, unlike those of most grasses, are not hollow, but are filled with pith which is saturated with sweet sap; it is this sap which is the source of sugar. The leaves are long and narrow and grow alternately, one from each node. When fully developed, each leaf consists of a basal sheath embracing the stem and a blade 3 to 4 feet long which is serrated or saw-edged at its margins. The flowers grow at the head of the plants and are of the type known as a *panicle*. They are soft and feathery and look rather like those of pampas grass.

Propagation is done by means of cuttings which are simply 8- to 10-inch lengths cut from near the tops of mature canes, each one including a node; the new plant grows by development of the bud and roots described above. The cuttings are placed in trenches, spaced 4 to 5 feet apart, and nearly covered with soil. They begin to sprout in about two weeks and mature and flower at an age of 8 to 15 months, depending on the climate and the variety of cane. The plant develops as an underground stem or rhizome from which several culms arise. After the cane is cut these rhizomes will produce two or three more crops before another planting is necessary. Before planting, the ground must be ploughed repeatedly, well fertilised, and kept clear of weeds.

Sugar cane requires a warm climate, with an average temperature of about 80°F, and a high rainfall – at least 60 inches a year.

Sugar-cane plant with inflorescence

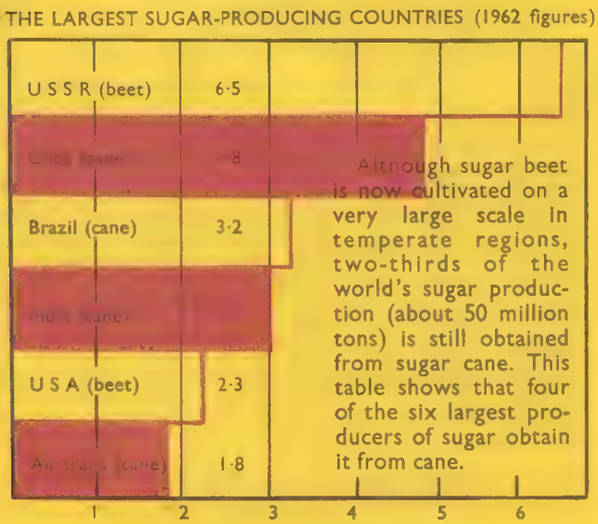
CLASSIFICATION

Species: officinarum
Genus: Saccharum
Family: Gramineae
Order: Glumiflorae
Class: Monocotyledoneae

CANE SUGAR

Sugars belong to the great group of organic substances known as carbohydrates; all of them are compounds of carbon, hydrogen, and oxygen. Cane sugar, or *sucrose*, is the most economically important of the sugars; taken as food it is an excellent source of energy. Beet sugar is also sucrose.

THE LARGEST SUGAR-PRODUCING COUNTRIES (1962 figures)



(figures in millions of metric tons)

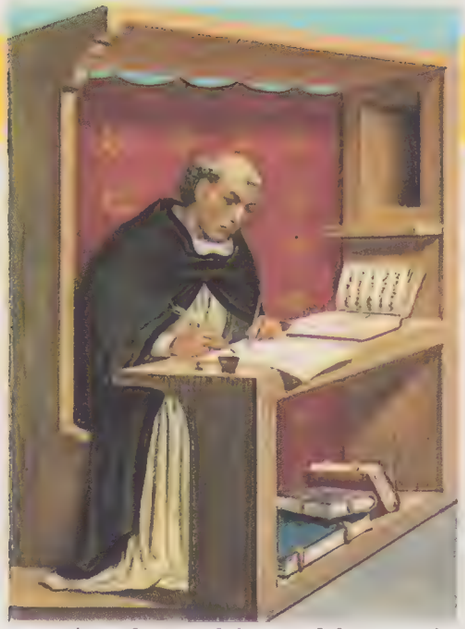
Although sugar beet is now cultivated on a very large scale in temperate regions, two-thirds of the world's sugar production (about 50 million tons) is still obtained from sugar cane. This table shows that four of the six largest producers of sugar obtain it from cane.

A sugar-cane seller in Madagascar

BY-PRODUCTS OF THE INDUSTRY

Molasses, a treacle-like by-product of refining, is used in confectionery and for making rum and industrial alcohol. The crushed cane residue, bagasse, can be mixed with molasses to make cattle food. It is also used for fuel, and can be compressed into sheets or boards for heat insulation and soundproofing in buildings.

MEDIAEVAL CULTURE



A monk at work in one of the monastic schools which were, in the early Middle Ages, the main centres of culture

IMAGINE a *Knowledge* written in 1250. You would certainly have read that all the planets revolved around the earth. You might also have read a serious debate on whether the earth was supported by a giant tortoise, or was square and ended in a colossal waterfall. There were, indeed, encyclopaedias in use in 1250 – but what is remarkable about them is that many of their entries on scientific subjects could have been written over 600 years previously. In fact, many were, being based on the work of St Isidore of Seville (570–636).

There were certain subjects of which mediaeval people were completely ignorant, and to understand mediaeval culture you must realise how single-minded it was. Most mediaeval scholars were not interested in whether the sun went round the earth, or whether the stars were holes in the floor of heaven, or, indeed, in any of the physical nature of this world. Rather, they were preoccupied with the next world and the prospects of getting there. Thus most of the learning was of a *theological* kind – to find out more about God and what He wanted.

In the early Middle Ages the Church dominated learning. The first schools were in monasteries. They were mostly for the monks themselves, for, on the whole, laymen were not tremendously interested in learning.

The scope of mediaeval learning was encompassed by the Seven Liberal Arts, philosophy, and some instructions on Church doctrine. The Arts were divided into the *trivium* and the *quadrivium*. The trivium consisted of grammar, dialectic, and rhetoric; the quadrivium, of geometry, arithmetic, music, and astronomy. Under the heading of *grammar* was included the study of literature and Latin. (Latin was very important, being the international language of scholarship and government. With it you could be understood in any country in western Europe. Without it you would not get anywhere in school or government.) Under *dialectic* was included logic and formal argument; under *rhetoric*, law, prose, and verse; under *geometry*, natural history, geography, and plane geometry; under *arithmetic*, the simplest of calculations; under *music*, plain chant and a little about the theory of sound; under *astronomy*, the movements of the heavenly objects and a certain amount of astrology.

In the 11th century learning began to spread rapidly in Europe. Schools appeared in many of the great cathedral cities. This movement blossomed in the 12th century – in fact, mediaeval historians sometimes talk about the 12th-century Renaissance. The movement was especially strong in France and Italy. To the famous cathedral schools like Laon, Chartres, and Paris, to the medical school of Salerno, and to the law school of Bologna came many students from all over Europe. Most of these were clerks – clergy who were not priests. There was a great demand for them in both secular government and the running of the Church.

There was glamour attached to these centres of learning. Life was gay, as many of the scholars' lyrics of the period testify. There were great controversies, too, which aroused tremendous passions even though they were of the most complicated theological kind. There were disputes between theological schools like the *nominalists* and the *realists*, and between great figures like William

Seal of the University of Salamanca, founded in 1243, and Spain's first university

The courtyard of the University of Bologna, the most famous institution for the study of law in Europe

MEDIAEVAL SCHOLARS AT WORK AND PLAY

'I and Pangur Bán my cat,
'Tis a like task we are at:
Hunting mice is his delight,
Hunting words I sit all night.

'Gainst the wall he sets his eye,
Full and fierce and sharp and sly;
'Gainst the wall of knowledge I
All my little wisdom try.

So in peace our task we ply,
Pangur Bán, my cat, and I;
In our arts we find our bliss,
I have mine and he has his.'

From a commonplace work by a scholar in one of the early monastic schools.

'In Paris the scholars seek the arts, in Orleans the authors, in Bologna codices, in Salerno gallipots, in Toledo demons – and nowhere good manners.'

An acid contemporary commentary on the students of the 12th century.

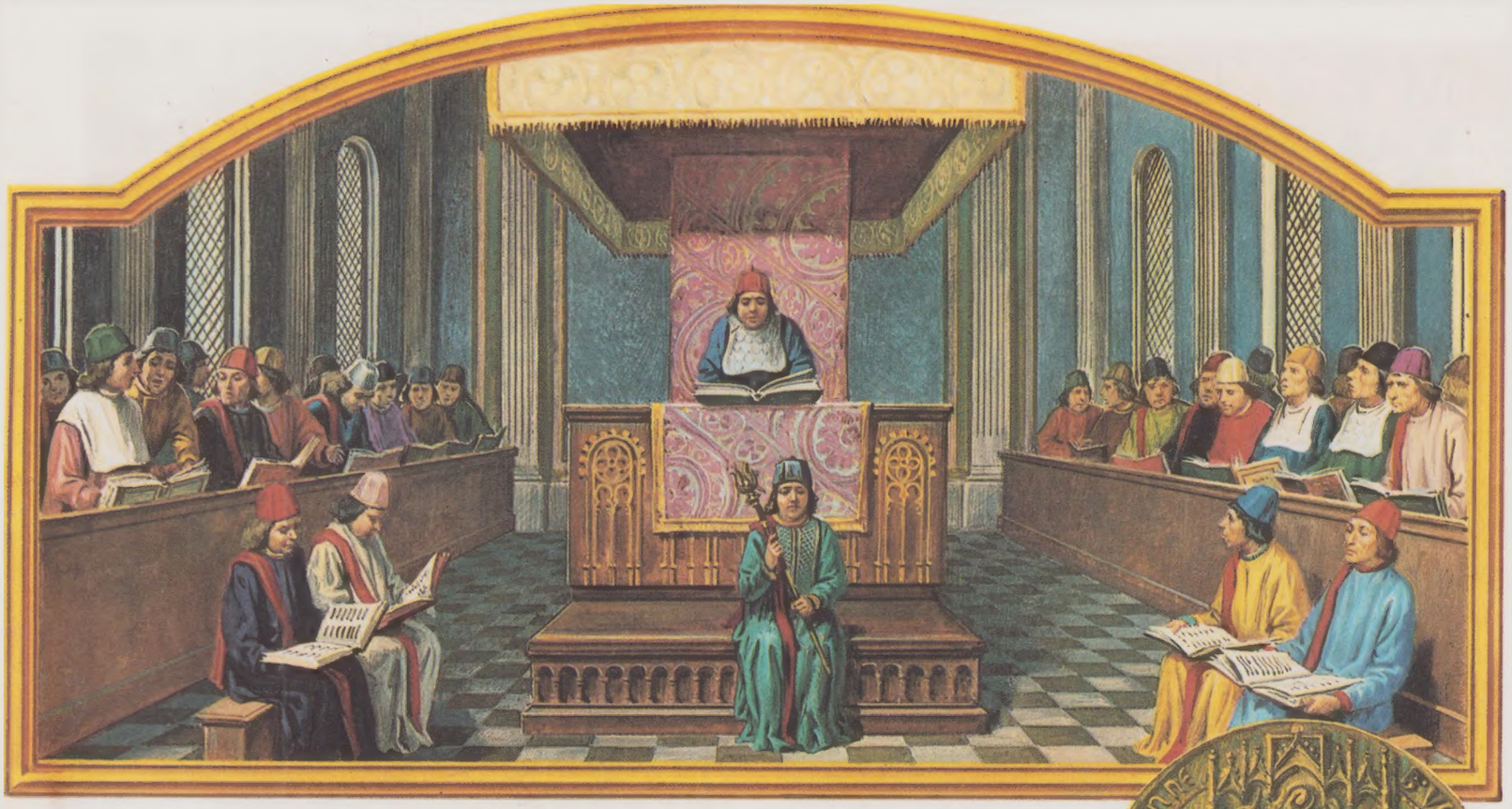
'Dearest father, when I was lately in Orleans, I had a row with a young man and the devil ministering unto me, I hit him on the head with a stick and now am shut up in Orleans gaol. But the young man is free, and better of his wound, and demanding his expenses off me, £10 Tours, and I can't get out until it's paid.'

12th-century student's letter home.

'Down the broad way do I go,
Young and unregretting,
Wrap me in my vices up,
Virtue all forgetting,
Greedier for all delight
Than heaven to enter in:
Since the soul in me is dead,
Better save the skin.'

One of the vigorous, witty, and often outrageous verses of the Archpoet, one of the greatest poets of the 12th century.

THE QUOTATIONS ABOVE ARE ALL TAKEN FROM HELEN WADDELL'S *THE WANDERING SCHOLARS*, PUBLISHED BY CONSTABLE.



Paris University was Europe's leading centre of theological teaching. Here a theology lesson takes place. In it the pupils follow the master's commentary on one of the standard texts

of Champeaux, Roscelin, and Abelard (1079–1142). Abelard was probably the most brilliant intellectual of the 12th century, and was treated with the enthusiasm reserved today for 'pop' stars. His lectures held Paris spellbound. Abelard was remarkable for his use of logic to test the dogmas of the Church. A doctrine, he thought, should not be believed just because God had said so, but because we are convinced by reason that it is so. Abelard's belief contrasted with that of another great mediaeval intellectual, St Thomas Aquinas (1225–1274). St Thomas considered that fundamental doctrines of Christianity did not have to be proved by reason – reason could not contradict them. Rather these doctrines should be, if possible, explained in the light of man's knowledge. Both Aquinas and Abelard were mainly interested in theological problems, as were most thinkers of the time. Roger Bacon (1214–1294) and Albert the Great (1193–1280) did much work on science, but they were exceptions.

FOUNDATION DATES OF THE FIRST UNIVERSITIES AND COLLEGES

Salerno (School of Medicine)	9th cen.	University College, Oxford	1249
Paris	1150–1170	Sorbonne College, Paris	1258
Oxford (definitely by 1190)	?1160–1170	Balliol College, Oxford	1263
Bologna	c.1200	Merton College, Oxford	1264
Cambridge	1209	Perugia	1276
Padua	1222	Peterhouse, Cambridge	1284
Naples	1224	Coimbra	1288
Toulouse	1224	Montpellier	1289
Salamanca	1243		
Genoa	1243		

Seal of Vienna – one of the first Germanic universities

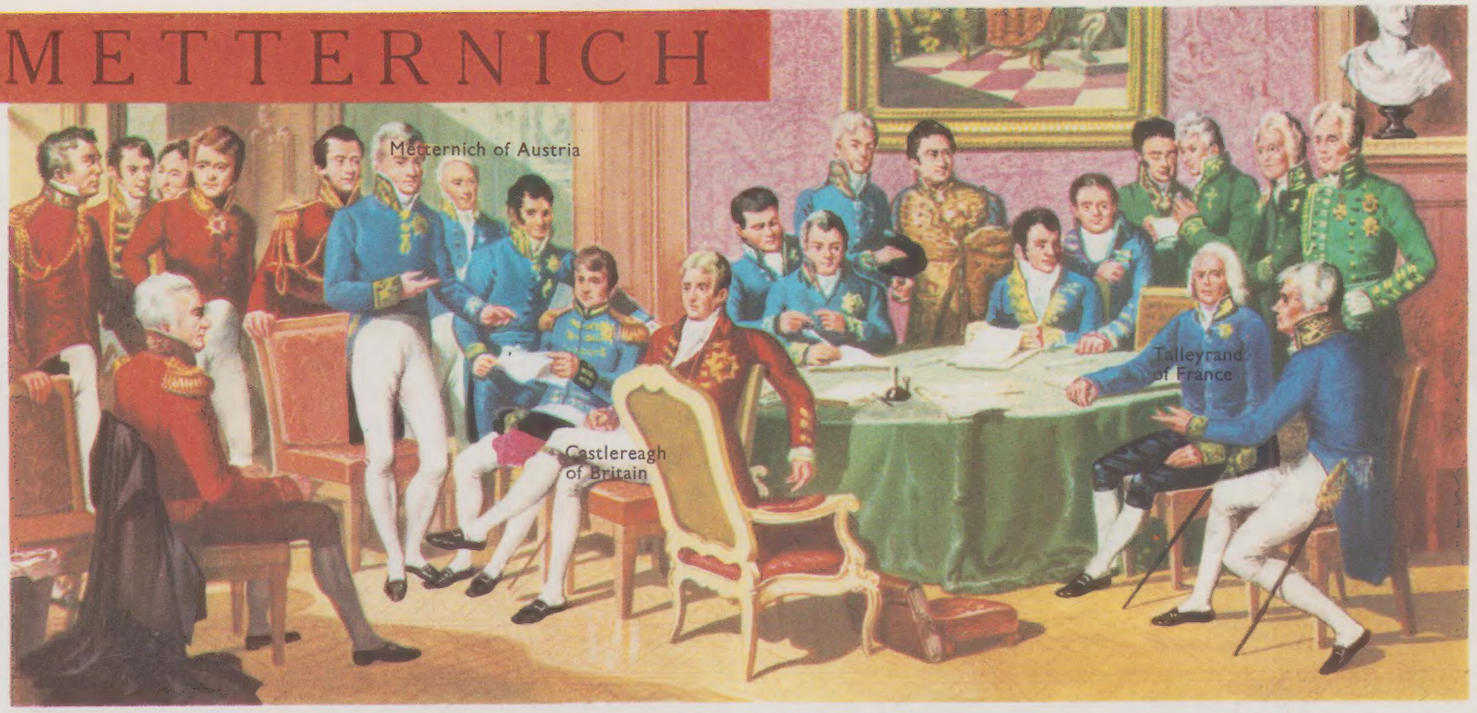
The rise of universities

The 12th century was the century of schools, the 13th that of universities. The universities grew out of the more famous schools. The word *universitas* means a guild or corporation, and the universities originated in the guilds of masters or students. These guilds could decide whom to admit, and had special privileges. The university was a *studium generale*; that means somewhere where people could go from all over Europe to learn or teach.

As universities became more important, popes, emperors, or kings reserved the right to make a school into a university. There were various *degrees* (from the Latin *gradus*, a step) through which students had to go: *Bachelor*, then *Master*, and finally *Doctor*. The latter meant the scholar had graduated. The curriculum, on the whole, was still based on the Seven Liberal Arts. But there was much more specialisation, particularly in law, theology, and medicine.

The 13th-century university had privileges but no very deep roots. There were few university buildings – the first colleges were merely halls of residence. The mediaeval universities were smaller than those of today: Paris never had more than 3,000 pupils, Bologna 2,000, and Oxford (see page 766) 1,500. There were no entrance examinations, and quite often 13-year-olds and 30-year-olds could be found at the same lecture. Teaching consisted mainly of lectures or commentaries on standard texts. There were also formal disputations among the pupils under the guidance of a master. Aristotle (see page 1222) was the authority in physics and philosophy; Galen (see page 433) and Hippocrates (see page 1970) in medicine. It was not considered necessary to go beyond these. Indeed, the ideal of mediaeval learning was not to find out new things but to explain what was already known.

METTERNICH



The Congress of Vienna, 1815 – the beginning of the Age of Metternich

IN 1815, after Napoleon's defeat, the greatest men in Europe had gathered at Vienna. Every night society hostesses threw fabulous balls. But behind the glittering façade of fancy dresses, masks, and minuets decisions were taken which affected the destinies of whole nations. And in that distinguished gathering no man moved with greater assurance and effect than the polished and perfectly mannered, yet subtle and ruthless, Prince Metternich of Austria.

Clemens Wenzel Lothar Metternich-Winneburg was born in 1773 at Coblenz. His father, a nobleman, was an ambassador for the Austrian government. Young Metternich studied at Strasbourg and Mainz, and soon developed a loathing for revolutions and 'liberalism', caused by the excesses of the French Revolution. In 1794 he entered his father's chancery in the Austrian Netherlands, and the following year made a brilliant match with the heiress Eleanor Kaunitz.

Metternich's rise was swift. In 1801 he became Austrian minister at Dresden; in 1803 he was appointed Ambassador at Berlin; and in 1806, at the request of the mighty Napoleon himself, Metternich was made Ambassador in Paris. Three years later he became Austrian Foreign Minister.

Metternich's accession to power came at a very difficult time for Austria. The French Emperor had humiliated the Austrians in battle after battle. He had ended the Habsburg-dominated Holy Roman Empire (1806), and, in its place, established the French-controlled Confederation of the Rhine in Germany. Metternich saw that the overthrow of Napoleon was essential, but also that he must bide his time and pose as Napoleon's friend. Thus he did not oppose – and may even have instigated – the marriage in 1810 between Napoleon and Marie-Louise, daughter of Emperor Francis of Austria. Shortly afterwards the international situation worsened as tension mounted between France and Russia. But Metternich still waited. Believing that France would win, he allied with her in return for the province of Illyria. Napoleon also promised him Prussian Silesia, if Prussia should 'make any mistake'. Metternich then secretly informed the Tsar that the Austrian troops would not fight seriously against the Russians. At the same time he urged Prussia to ally with Russia!

Tortuous as it was, Metternich's policy paid rich dividends. Austria remained uncommitted while Napoleon suffered a decisive reverse in the Russian campaign of 1812 (see page 2507). Metternich promptly presented the weakened Emperor with huge demands. The main one was that the Germanic Confederation be abolished. This Napoleon refused to do, and Austria confidently declared war in the summer of 1813. So began an anti-French coalition that was to culminate in the battles of Leipzig and, eventually, of Waterloo.

On 10th April 1814, after Napoleon's first abdication, Metternich entered Paris in triumph. He was now a prince. At the Congress of Vienna, which concluded the Napoleonic Wars, Metternich's was the dominant voice. He established Austrian hegemony (leadership) in Germany by setting up a Federation of Independent States under Austrian presidency. He resurrected Austrian power in Italy by the annexation of Lombardy and Venetia, making his famous remark: 'Italy is a geographical expression.' His close understanding with Castlereagh enabled him to deal with the enormous demands of Prussia and, particularly, Russia, which, at one time, threatened to destroy the Congress.

For the remainder of his career Metternich set himself to maintain the 'balance of power' system he had erected at Vienna. Europe between 1815 and 1848 is often called 'Metternich's Europe'. This is because there were few major adjustments made to his work at Vienna, and because nationalism and liberalism, which Metternich hated, were suppressed.

But in 1848 revolts flared in nearly every country in Europe. The liberals in Vienna howled for Metternich's blood in retaliation for the system of censorship, police, and spies he had established throughout Germany by the Carlsbad Decrees of 1819. Metternich fled – it was the end of his political career. Italy and Hungary clamoured for independence. When he died in 1859 he had outlived his era.

One should not altogether condemn Metternich's Europe. Between 1815 and 1848 a generation was born and reached maturity without seeing a major war. That cannot be said for the years dominated by many of the other great figures of history.

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two important things happened. The Chancellor, Gustav Stresemann, died, and no adequate replacement could be found. At the same time the Wall Street crash caused economic chaos internationally. American loans and investment in Germany, which had bolstered up the economy for years, were withdrawn. The value of money dropped alarmingly. Unemployment figures rocketed until they reached 6 million. Everywhere there was panic and discontent. The discontented flocked to support either the Nazis or the other extremist movement, Communism. In 1930 107 Nazis were returned to the *Reichstag* – a startling success – and in 1932 Hitler was only narrowly defeated by Hindenburg in the presidential elections.

By this time the Nazis, with 230 seats in the *Reichstag*, were the largest political party in Germany. Several Chancellors were tried by the ageing President Hindenburg, but none could command regular majorities in the *Reichstag*. Finally one of them, von Papen, persuaded Hindenburg to make Hitler Chancellor, hoping that he, von Papen, could use Hitler as a puppet yet gain the support of the Nazis in the *Reichstag*. He was sadly wrong. Hitler became Chancellor in January 1933, and at once the Nazis began to practise what they had preached. Their main object, to grab power, was swiftly achieved. A mysterious fire in the *Reichstag* gave Hitler an excuse for purging the Communists from Parliament, and the Nazis now had an absolute majority. In March 1933 an Enabling Law gave Hitler, as Chancellor, dictatorial powers. In July Germany became officially a one-party state. The following year Hindenburg died, and Hitler combined the post of President and Chancellor with the title *Fuehrer* or leader. Prominent Nazis filled virtually all the important positions, and from then on the Germans' destiny was in the hands of men like Himmler, Goebbels, Ribbentrop, Goering, and Hess.

The Nazi organisation expanded rapidly until it reached every man, woman, and child in the State. For example, there were Nazi organisations like the military S A (storm troopers) and the police S S (secret police); there was the Hitler Youth, from which, in theory, Nazis were exclusively recruited after 1935. And there was the Labour Front which replaced trade unions, and of which membership was compulsory. Having achieved power in Germany, the Nazis set about dominating Europe. In 1936 Hitler remilitarised (sent German troops into) the Rhineland. Although this was forbidden by the Treaty of Versailles, no one lifted a finger to stop him. In 1938 he annexed Austria, and in the same year he persuaded France and Britain at Munich to allow him to annex the Germanic part of Czechoslovakia. But the following year Hitler went too far. On 1st September 1939 he invaded Poland. Poland was crushed by the heavy armoured Panzer divisions, built up during Germany's extensive programme of rearmament. On 3rd September Britain and France declared war on Germany, and the Nazi Party's final struggle for world supremacy had begun. It ended five and a half years later amongst the ruins of Berlin. Today a divided Germany is paying the price for the brief career of the Nazis and their promised '1,000-year *Reich* (Empire)'.

Hitler fools Germany – he denounces 'provocation' by Britain

HOW HITLER DECEIVED THE WORLD

Hitler fools Hindenburg – he is appointed Chancellor

Hitler fools Britain – Chamberlain, the British Prime Minister (left), agrees to his plan for Czechoslovakia

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IDEOLOGIES. The 1930s saw conflict between several rival *ideologies* or theories of government. The nations which followed them can be broadly divided into two categories: the *democracies*, which believed that the State existed for the sake of the individual and that the individual had rights which should not be taken away by the State; and the *totalitarian* states, which believed that the State was what mattered, and if the rights of the individual conflicted with the needs of the State, it was the State which won. Among totalitarian states were Hitler's Nazi Germany, Mussolini's Fascist Italy, and Stalin's Communist Russia.

Fascism was the word used to describe Mussolini's form of government. The Fascists seized power in Italy in 1922 and Mussolini ruled as a dictator. Hitler owed much, including his Roman salute and title of 'leader', to Italian Fascism. In fact, today, the word *Fascist* is applied to any dictatorial government which ignores the rights of the individual. Such governments usually have censorship powers over the Press, and control the judges.

The most interesting difference between Fascism and Communism is the emphasis placed on the individual leader. Fascists believe in the personal decisions and influence of an 'inspired' leader. The Communists believe that the government has no real part to play in history and that all events are the product of economic laws and material progress. But there is an even more significant difference between the two. Although Communist governments use methods similar, in some ways, to those used by Fascist governments, their aims are totally different. For whereas the Fascists believe in powerful states, the Communists hope ultimately for the 'withering away' of states altogether. Their aim, or, at least, Karl Marx's aim (see Communism), is the establishment of a classless society with no international boundaries.

THESE WERE THE MEN who, together with Hitler, ran Germany: **Hermann Goering,** a former *Luftwaffe* (Air Force) pilot, who rose to be Reich Marshal, Marshal of the *Luftwaffe*, and second in line to Hitler himself. He was sentenced to death at the Nuremberg trial of war criminals, but succeeded in committing suicide. **Heinrich Himmler** was an ex-poultry farmer who became head of the S S and, after Hitler, the most feared man in Germany. He was responsible for the extermination of the Jews, and committed suicide after his capture at the end of the war. **Josef Goebbels,** the Nazi intellectual, became Minister of Enlightenment and Propaganda. During the war he was one of the few top Nazis to visit bombed cities and raise the morale of civilians. He committed suicide, with Hitler, in the Berlin bunker. **Alfred Rosenberg** was the Nazi biologist and philosopher. His ridiculous doctrines of the supremacy of pure Aryan blood have been described as 'brutal Nordic nonsense', but were widely believed by the fanatics of the S S. **Joachim von Ribbentrop** was Hitler's foreign minister in the years after 1938. Hitler described him as 'a second Bismarck'. In fact, his lack of understanding of Britain and France had much to do with Germany's provoking them into war. **Rudolf Hess** was one of the earliest Nazis. He never held an important post, but became very influential in the party and was named, after Goering, as successor to Hitler. He was of unstable mind, and Hitler called him 'mad'. In 1941 he flew to Scotland and remained a prisoner till the end of the war. He was sentenced to life imprisonment at Nuremberg. **Admiral Karl Doenitz** was an ex-U-boat commander who was named by Hitler as his successor the day before he, Hitler, died. He was sentenced to imprisonment at Nuremberg. **Field-Marshal Wilhelm Keitel** was chief of Hitler's O K W (Combined General Staff). At Nuremberg he protested that he gave his army no orders but that Hitler did it for him. He was sentenced to death and executed.

Heinrich Himmler – feared head of the S S

Hermann Goering – Hitler's deputy

Josef Goebbels – the Nazis' propagandist